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Dynamics of Soil Degradation and Incentives for Optimal Management among Small Holder Cassava Farmers in Ebonyi State, Nigeria

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Abstract
Ebonyi State government is highly interested in food security and poverty alleviation through crop production. Cassava plays food security roles in Ebonyi state, as it supplies basic food. But the production of cassava in the study area is dominated by small holder farmers and is highly constrained by soil degradation. This study was then designed to identify the dynamics of soil degradation and incentives for optimal soil management for enhanced food production. The study was a survey research designed as it used questionnaire to elicit information from a sample of farmers and extension agents. The questionnaire was developed by the researcher and validated by three (3) experts. Data collected through the questionnaire were analyzed using mean to answer the research questions. Major Findings on causes of soil degradation were excessive land use, exposure of land to erosion, leaching and bush burning. Findings on effects were increase in cost of farm resources, poor yields and low incomes to farmers Incentives identified were greater access to credit facilities, farmer education, and improvement in agricultural marketing. It was recommended that government should increase farmers' access to loan, subsidies and better markets. While extension agents should train farmers on soil management methods.
Keywords: Dynamics, Soil Degradation, Incentives, Cassava Farmers and Management

Introduction

Cassava (manihot esculeta) is rated as the most important food crop in Ebonyi State and its production dominates all parts of the state both in terms of area covered and number of farmers growing the crop (Ekpe and Alimba, 2013). In all locations, cassava has become a very popular crop among farmers in Ebonyi State and other states in southern Nigeria. This statement is in keeping with the views of Toluwase and Abdu-Rahan (2015) that cassava products such as garri (toasted granules), fufu (fermented pastes), chips, flour and or fresh roots are the most important carbohydrate staples of rural and urban household in southern Nigeria. The authors stressed further that Nigeria is making use of cassava production to boost its economy. Thus, Ekpe and Alimba (2013) remarked that Ebonyi State hopes to utilize cassava and rice production to diversify its economy away from petroleum. Egbe (2011) said that cassava production provides income and employment to farmers especially women who engage in it production, processing and marketing enterprises. In fact, cassava plays food security role in time of famine and civil disturbance. In spite of the numerous benefits, the production of cassava in Ebonyi State is still dominated by small scale farmers who face various production and price risks. Price risks arise from the fluctuations in market prices of the farm resources and prices of farm produce. While production risks emanate from climate change and dynamics of soil degradation.

In the words of Hornby (2010) dynamic is a force process or system characterized by changes. In the context of this study, dynamics refer to the pattern and effects of changes in the soil quality over time. It is that change in the suitability of the land for cassava production, which may lead to soil degradation.

Soil degradation is explained by Ajayi (2015) as the physical, chemical and biological decline in soil quality. It is a reduction in the value and productivity of the soil due to the breakdown in its structure, loss of its nutrients, water logging and pollution. Food and agricultural organization of the united Nations (FAO, 2014) defined soil degradation as a change in the soil health status resulting in diminishing capacity of the ecosystem to provide goods and service to the beneficiaries. In this study, soil degradation is explained as a decline in soil conditions caused by tits improper use and poor management. It is a reduction in the capacity of the soil to benefit small scale cassava farmers.

In Ebonyi State soil degradation is observed as one of the major environmental problems that affect and reduce incomes of farmers. This is true, as it increases cost of production and reduces yields from crop farms. (Egbe, 2011). In fact, soil degradation is now a major challenge, constraining small holder cassava farmers from getting up to an acceptable level of food security through cassava production. Soil degradation is caused by certain forces associated with agricultural land, and these forces that lead to changes in soil value are collectively referred to as dynamics of soil degradation.

Dynamics of soil degradation is then explained in this study as any act on the soil that changes it from its natural ecological status and makes the soil unfit for effective use by small scale cassava farmers. It also

includes the causes of the soil degradation, its impacts on farmers and incentives needed by farmers to optimally manage the soil.

Soil management according to Amusa, Enete, Oketobo and Okon (2016) connotes proper planning of land use, monitoring of changes in the status of the soil, and use of various techniques to improve soil value. To manage the soil in this study means to adopt cultural practices such as crop rotation, mulching, cover cropping, minimal tillage and addition of organic manures and lime materials. Small holder's cassava farmers could adopt these techniques to manage the soil for enhanced crop yields through provision of incentives.

Incentives are explained by Nakhumwa (2012) as inducement or supplemental reward that serves as a motivational device for desired action. It is something that encourages a person to work harder. Food and Agricultural Organization Report (FAO, 2012) explained incentives as strategies used by public and private sectors to encourage farmers to protect or enhance ecosystem services beneficial to them and others. In this study incentives means assistance given to farmers to enable them manage the soil to enhance cassava production. The FAO (2012) reports hold it that farmers' incentives for soil managements include proper land use rights and regulations, improved knowledge and training and greater access to farm inputs such as credits, and soil improvers. With incentives, small holder cassava farmers can adjust the use of land, raise the future worth of soil resources and cater for multiple plots of heterogeneous soil quality but farmers incentives to invest in soil conservation and soil fertility improvement practices are in short supply. The inadequate incentives coupled with population pressure on land expose small holder cassava farmers to greater production risks. (Egbe, 2011).

In his views, Egbe (2011) said that small scale cassava farmers dominate cassava farm enterprises in Ebonyi State. The author stated further that the small scale farmers operate under subsistence agriculture, depend largely on traditional methods of farming and face various land use problems that force them to stay on continuous cropping on fragmented degraded pieces of land without incentives for their management.

Today small scale cassava farmers suffer land depletion problems. That is, the land is exhausted due to continuous use without resources to replenish it. It is commonly observed that farmers get lesser produce than the expected output from a given cassava farm. Despite the seriousness of soil degradation problems commonly observed in Ebonyi State, there have been little or no information on causes, effects of soil degradation and the incentives needed by farmers to optimally manage the soil. It is against this background that this study was designed to determine ways of assisting farmers to manage the soil for optimal cassava production.

Objectives of the Study

The major objective of this study was to determine the dynamics of soil degradation and the incentives required by small scale cassava farmers to optimally manage the soil for enhanced cassava production. Specifically the study sought to:

1. Identify the dynamic forces that derive in soil degradation among small holder cassava farmers.
2. Determine the impacts of soil degradation on small scale farms in the study area.
3. Ascertain the incentives required by the small scale farmers to manage the soil for enhanced cassava production.

Methodology

The study area was Ebonyi State purposively chosen because of the great interest of small holder farmers in cassava production, which is influenced by soil degradation. Multi-stage random sampling technique was used to select six communities from each of the three educational zones of the state. Thereafter, 11 registered cassava farmers, and 7 extension agents were randomly selected from each of the 18 communities identified for the study. This gave 324 respondents, made up of 198 registered cassava farmers and 126 extension agents.

The instrument for data collection was a questionnaire developed by the researcher on four point scale. It was validated by 3 experts, one each from soil science, crop science and agricultural education units respectively all from Ebonyi State University, Abakaliki. Data collected through the questionnaire were analyzed using mean to answer the research questions. The cut-off point of 2.50 was estimated from the scale values of the four rating options and was used as a decision rule.

Results and Discussions

Data for answering the research questions were analyzed and presented in order of research questions using tables.

Research Question 1

What are the dynamics forces that derive in soil degradation among small scale cassava farmers?

Table 1: Respondents' View Points On The Forces That Derive In Soil Degradation Among Small Scale Cassava Farmers.

S/N	Items on causes of soil degradation	$\bar{X}$	SD	Remarks
1	Excessive land cultivation destroys soil texture and structure and finally degrade the soil	3.03	0.55	HA
2	Continuous cropping of cassava on a piece of land exhausts and reduces soil value	3.05	0.53	HA
3	Exposure of land to erosion washes away and depletes soil nutrients	3.08	0.51	HA
4	Crop removal through clean clearing, deforestation or continuous harvesting of cassava leads to soil degradation.	2.97	0.59	HA
5	Bush burning degrades the soil by killing soil microbes and loss of volatile soil nutrients	2.76	0.66	A
6	Extreme weather conditions such as drought and flood influence microbial activities and reduces status of the soil	2.81	0.65	HA
7	Overgrazing destroys the structure of the soil and leads to loss of soil fertility in study area.	2.47	0.69	NA
8	Leaching degrades the soil in the study area by draining mineral salts	2.68	0.63	SA
9	Poor access to needed soil management resources like manures and limes derive in soil degradation.	2.87	0.64	HA

Source: field survey, 2016

Key: HA = Highly accepted
A = Accepted
SA = Slightly Accepted
NA = Not Accepted

Data presented in table 1 show that eight out of mine items have means above the cut-off point of 2.50. the close range of standard deviations, from 0.53 to 0.69 signifies that the respondents are close in their opinions and their respective opinions are not far from the mean. This implies that each of the eight item is accepted as a force that derive in soil degradation in the study area.

Items on exposure of land to erosion ($\bar{X} = 3.08$), continuous cropping ($\bar{X} = 3.05$), excessive land cultivation ($\bar{X} = 3.03$), and crop removal ($\bar{X} = 2.97$) enjoyed very high mean ratings. These findings agree with the findings of Aniagboso and Iwuchukwu (2011) and Ajayi (2015) that continuous cropping, excessive land use, erosion and lean clearing cause soil degradation. The findings of this study also agree with the results of a study by Afroz (2014) on soil degradation, that soil erosion, leaching and extreme weather conditions cause soil degradation.

High mean ratings on continuous cropping and extensive land cultivation is an indication that there is great pressure on the land in the study area. These farm practices lead to soil erosion which further degrades the land, especially as farmers have poor access to soil improvers as indicated by the results of this study.

The item on over grazing was rated below cut-off point by the respondents with a mean of 2.47. This signifies that the item is not accepted as a cause of soil degradation in the area. This finding is in keeping with

the agricultural practice of the people who are extensive crop producers but keep few livestocks. This finding indicates clearly that small holders farmer continuously use the land for crop production. The practice that exhausts the land and makes it less fertile

Research Question 2

What are the effects of soil degradation on small scale cassava producers in the area?

Table 2: Mean Ratings of the Respondents' Opinions on the Effects of Soil Degradation on Small Holder Cassava Producers.

S/N	Items on effects of soil degradation	$\bar{X}$	SD	Remarks
1	Soil degradation increases cost of farm resources for cassava production	2.96	0.56	HA
2	Degraded soil continuously reduce farm returns, incomes and socio-economic wellbeings of farmers	3.11	0.48	HA
3	Loss in soil value leads to rural – urban migration, thus shortage of farm labour	2.99	0.55	HA
4	Degraded soils are more vulnerable to pest attack to crops, thus a loss in the productivity.	2.77	2.60	A
5	Reduction in soil productivity affects farmers' household demographic attributes	2.74	2.61	A
6	Soil degradation affects physical and socio-cultural life of farmers	2.62	0.66	SA
7	Loss in soil value lowers farmers' level of adoption of agricultural technologies	2.69	2.67	SA
8	Soil degradation lowers food production and increases risks of famine.	3.19	0.42	HA
9	Degraded soils reduces production of cassava for industrial use.	2.84	0.59	HA
10	Soil degradation leads to reduction in protective functions of ecosystem and biodiversity in agriculture.	2.76	2.63	A

Source: field survey, 2016

Data presented in the table 2 have mean ratings ranged from 2.62 to 3.19, signifying that each item is accepted as an effects of soil degradation on small holder cassava farmers. The respondents' opinions show that items on the loss in soil value increases risks of famine ($\bar{X} = 3.19$), reduces income and socio-economic well beings of farmers ($\bar{X} = 3.11$), leads to rural-urban drift and shortage of farm labour ($\bar{X} = 2.99$), increases cost of farm inputs ($\bar{X} = 2.96$) and reduces raw materials to local industry ($\bar{X} = 2.84$), were highly favoured.

These findings agree with the reports of Mukadasi (2011) that soil degradation leads to rural poverty, low food production, unemployment, and collapse in the agro-allied industries. The findings of this study testify that people in the study area depend greatly on cassava production for food supply, employment, industrial development and income generation. These findings are also in keeping with the findings by Khadija (2013) on his research on soil erosion. He found out that soil erosion causes soil degradation and the degraded soil is more vulnerable to pest, diseases and bad weather conditions.

The results of this study reveal further that soil degradation affects the protective functions of the ecosystem ($\bar{X} = 2.75$) and demographic attributes of farmers ($\bar{X} = 2.74$). These results are in keeping with the opinions of Kodio, Otreno and Ang'awa (2015) that soil degradation affects the farmers' life and his environment.

The close range of standard deviation ($0.42 \; to \; 0.67$) shows how close the respondents are in their opinions and which are not far from the mean. This implies that something positive needs to be done to assist farmers manage the soil for enhanced cassava production.

Research Question 3
What are the incentives required by small scale farmers to manage the soil for enhanced cassava production?
Table 3: Mean Ratings of the Respondents' Opinions on Incentives Required By Small Scale Cassava Farmers To Manage Soil for Cassava Production.

S/N	Items on incentives needed by small scale cassava farmers.	$\bar{X}$	SD	Remarks
1	Greater access to credit or loan facilities will entice small holder cassava farmers to optimally manage the soil.	3.02	0.44	HA
2	Effective land use policies and regulations will assist cassava farmers to manage the soil	**2.72**		**A**
3	Improved extension farmer education will equip small holder cassava farmers for soil management	3.0	0.45	HA
4	Improvement in land rights and ownership will help farmers to adjust the use and management of soil	2.91	0.53	HA
5	Subsidizing farm inputs like fertilizers and lime materials will motivate farmers to manage soil for cassava production.	2.99	0.49	HA
6	Stabilization of market and prices of cassava produce is an incentive to farmers to invest in soil management.	2.93	0.52	HA
7	Development and provision of cassava varieties with high resistance to environmental stress is an incentive for soil management.	2.71	0.60	A
8	Provision of adequate agricultural information to farmers will encourage them to optimally manage the soil.	2,74	0.57	A
9	Provision of a viable value addition chain linking farmers to both local and international markets will motivate farmer to invest on soil management	2.84	0.55	HA

Source: field survey, 2016
Data presented in table 3 revealed the major incentives required by the small holder cassava farmers for optimal soil management. The study identified those incentives to be greater access to credit facilities ($\bar{X} = 3.02$), provision of effective extension education to farmers ($\bar{X} = 3.0$) subsidizing soil improvement resources ($\bar{X} = 2.99$) and stabilizing markets and prices of cassava produce. These results which centre on financial supports and education or training of farmers are consistent with findings of other researchers Nakhumwa, (2012) and Oguleye, (2015), that farmers, need credit facilities, knowledge, and better markets for soil management. With financial capital, farmers can secure equipment, better farm plots, improve cassava stock and then manage soil resources such as water and soil nutrient.

Poor soil fertility which characterizes the study area due to over exploitation of soil resources without replenishing the exhausted land called for high mean ratings on improved land rights and land ownership ($\bar{X} = 2.91$), effective land use policies and regulations ($\bar{X} = 2.72$) and improved high yielding cassava varieties that can withstand environmental stress ($\bar{X} = 2.71$). These findings are in keeping with the results of Mwango and Mbugua (2013) that farmers need assistance in securing and use of land, up-scaling the existing cassava value addition mechanisms through processing of cassava products and linkages between smallholders farmers and food markets. The results of this study are also in keeping with the popular opinion that land is inadequate for cassava production in the study area.

Conclusion and Recommendations

The study identified forces that derive in soil degradation and the effects on small holder cassava farmers. To deal with the causes and effects of soil degradation, the study also identified incentives for the cassava farmers to manage the soil for optimal crop production. For the farmers to effectively manage the soil

for crop production, it is recommended that smallholder cassava farmers should be properly trained by extension agents and adequate information given to them on soil fertility management.

Again, government should assist farmers with loan facilities, subsides on farm inputs, effective land use policies; and stabilized prices of cassava products. All these could help to up-scale farm holdings of cassava farmers, through improved farm returns, enhanced food supply and greater incomes.

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